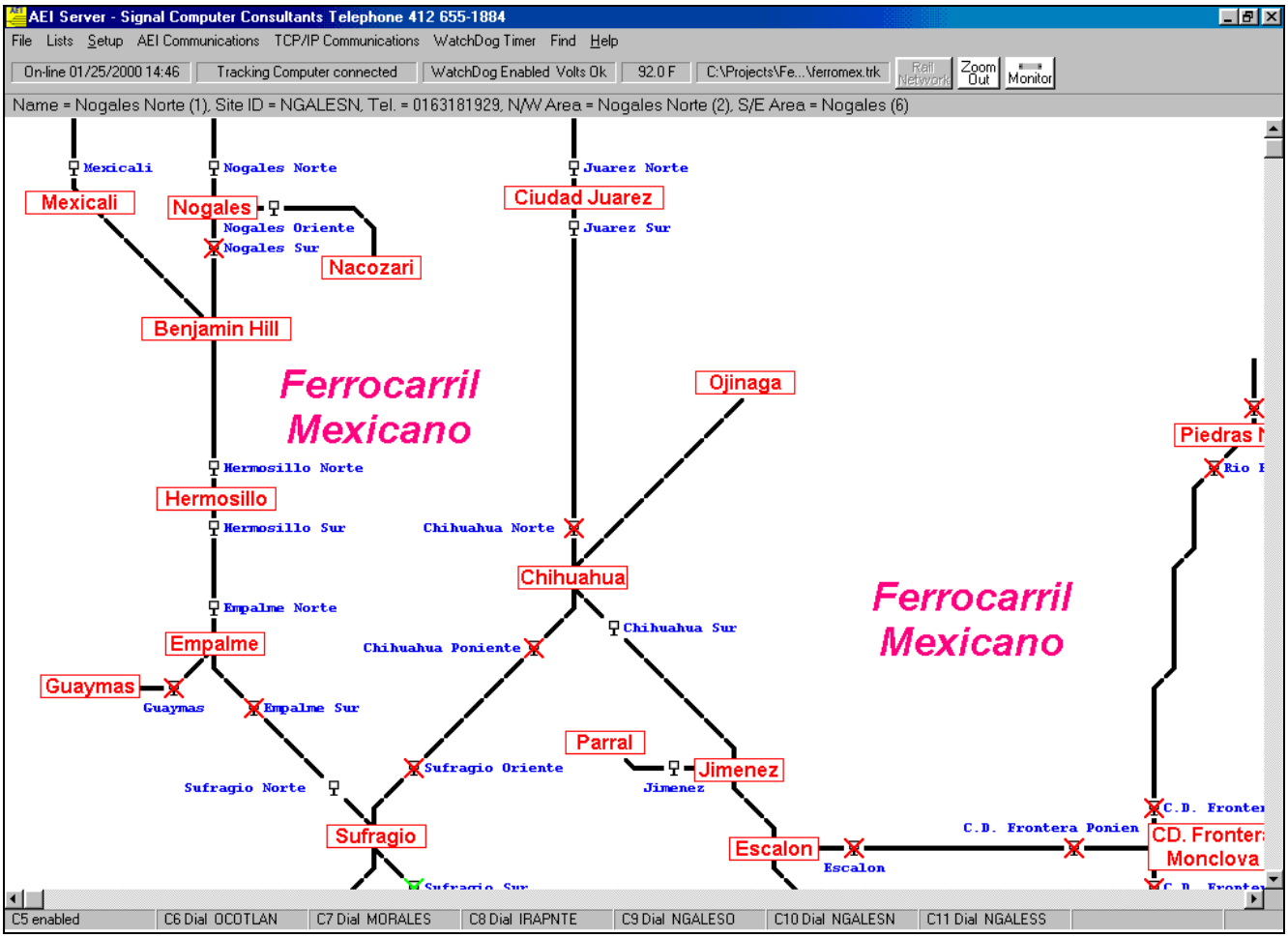
AEI RAIL NETWORK SERVER

User Manual

24 February, 2000



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1. INSTALLATION

1.1. Loading the Program

AEI Rail Network Server is a 32 bit Windows program that will run on systems running Windows 95, Windows 98 or Windows NT 3.51 or later. It will not run under Windows 3.1.

The AEI Rail Network Sever program comes on a single 3.5" disk. To install the program, insert the disk into your drive and click the Start and then the Run buttons. In the Open box, type a:setup if you placed the disk into Drive A or b:setup if you placed the disk into Drive B. Follow the instructions in the Setup program to complete the installation.

When AEI Rail Network Server is installed, the Setup program will create an AEI Rail Network System folder and an AEI Rail Network Server program icon.

1.2. Starting the Program

To start the program, click the Start button, point to Program and then to the AEI Rail Network System folder and click on the AEI Rail Network Server program.

After starting the program, the Network Map display appears (see Figure 2).

2. SYSTEM OVERVIEW

2.1. Hardware Configuration

The AEI Rail Network Server is a program that runs on one or more dedicated computers that collect AEI tag information from wayside AEI readers. This information is automatically sent from the AEI readers to the computer(s) running the AEI Rail Network Server program over dial-up telephone connections whenever a train passes an AEI reader site. The computers running the AEI Rail Network Server program will also periodically dial-up the AEI readers to insure that they are operating correctly and to obtain AEI tag information that has not already been received.

From this point on in this document we will refer to the computer(s) running the AEI Rail Network Server program as simply AEI server(s) or server(s). The server or servers pass the tag information to another computer that runs the AEI Rail Network Tracker program, which tracks vehicle movements based on the AEI information received from the servers. Figure 1 shows the hardware configuration of the system.

2.2. System Reliability and Maintainability

The AEI servers have two principal functions. The first is to obtain AEI tag data information from the AEI readers and pass this information to the computer running the AEI Rail Network Tracker program or other vehicle tracking system. The computer running the AEI Rail Network Tracker program will be referred to as the AEI tracking computer or simply tracking computer from this point forward in this document.

The second is to provide a highly reliable and maintainable system. To accomplish this, the servers have two main features. First, the servers operate in a hot-standby configuration that allows the

backup or off-line server to immediately take control if the primary or on-line server has a software or hardware failure.

Second, the servers constantly monitor AEI reader sites by periodically calling the sites to determine their status. AEI reader status is displayed on the network map (see Paragraph 3.3). The servers also provide a number of tools for diagnosing problems with the readers. See Paragraphs 4.4 and 4.5.

2.2.1. Hot-standby and Watchdog Timer Operation

Two servers are used in the system, and they are in a hot-standby configuration with one server being on-line and the other off-line. When a server is on-line it is connected to the telephone lines by a gang switch. When off-line, the server is not connected to the telephone and will not try to communicate with the AEI readers.

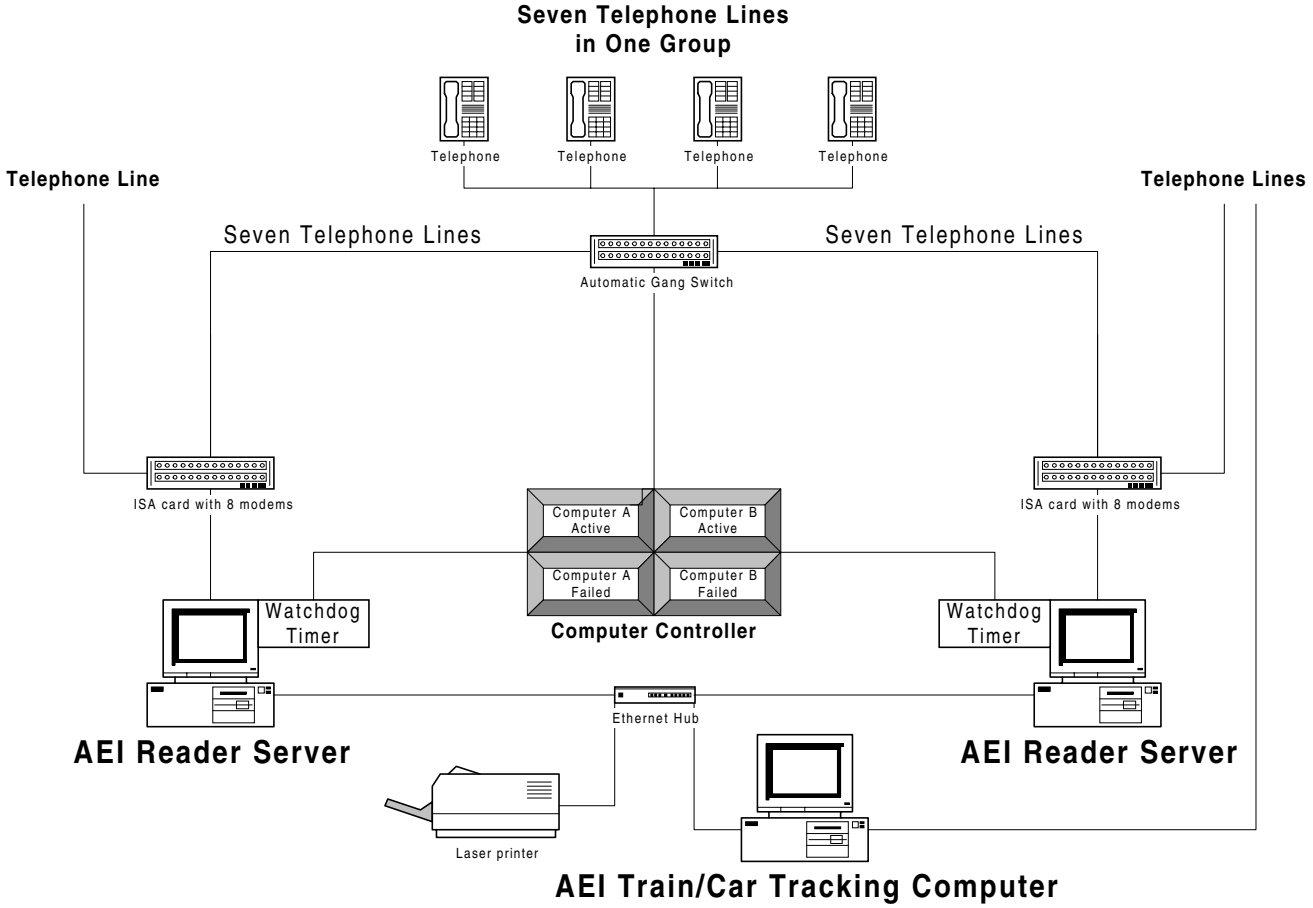


Figure 1 - Hardware Configuration

The on-line server communicates with the AEI readers and sends new AEI vehicle data received from the AEI readers to the computer running the AEI Rail Network Tracker program over a local area network. The on-line server also sends the latest AEI reader status with a copy of the recent vehicle data to the off-line server.

If the on-line server fails or control is switched to the off-line server, the off-line server status changes to on-line. Because the old on-line server continuously updated the old off-line server, the new on-line server will have the latest AEI reader status so that it can continue communicating with

the AEI readers. The gang switch always transfers the telephone lines to the on-line server. Each server has its own set of eight modems, seven of which are used for communicating with the AEI readers with one used for external diagnostic access to the server.

There are two ways the on-line/off-line status of the two servers can be changed. The first is a manual operation where the user pushes a button on the Computer Control Box to switch the status of the two servers.

The second method is a failure of the on-line server that causes the off-line server, if it has not also failed, to be automatically switched to an on-line status.

Each server has a Watchdog Timer installed. Each Watchdog Timer provides an output to the Computer Control Box informing the controller if the Watchdog Timer is enabled and has not failed. When the AEI Rail Network Server program starts to run it enables the Watchdog Timers and sets the Watchdog Timers' countdown timers. Each Watchdog Timer will independently decrement its countdown timer on a regular time interval. To prevent the countdown timer from reaching zero the AEI Rail Network server program periodically resets the countdown timer. If the AEI Rail Network Server program is prevented from resetting the countdown timer in a specified amount of time due to a software or hardware problem and the countdown timer is allowed to reach zero, an output is sent to the Computer Controller informing it that the server's Watchdog Timer has failed. This causes an automatic transfer of control if the on-line server is the one that has failed.

When a computer has a Watchdog Timer failure, it must be re-booted to reset the Watchdog timer's failure flag.

Each server has an automatic re-boot option. A physical switch located on the back of each server on one of the PCI/ISA slot cover plates enables this option. When the Watchdog Timer fails, the server will automatically re-boot, load and execute the AEI Server program and reset the Watchdog Timer failure flag if the re-boot option is enabled. Once this operation is completed the server will assume a hot-standby status and wait for the on-line server to fail.

3. RAIL NETWORK MAP

When the AEI Rail Network Server program begins, a map of the AEI reader network is displayed (see Figure 2). This map was built by the AEI Rail Network Builder, which creates a Track file (Track files have a .trk file name extension). The AEI server uses information in this file to create a map and generate a database of the AEI reader sites.

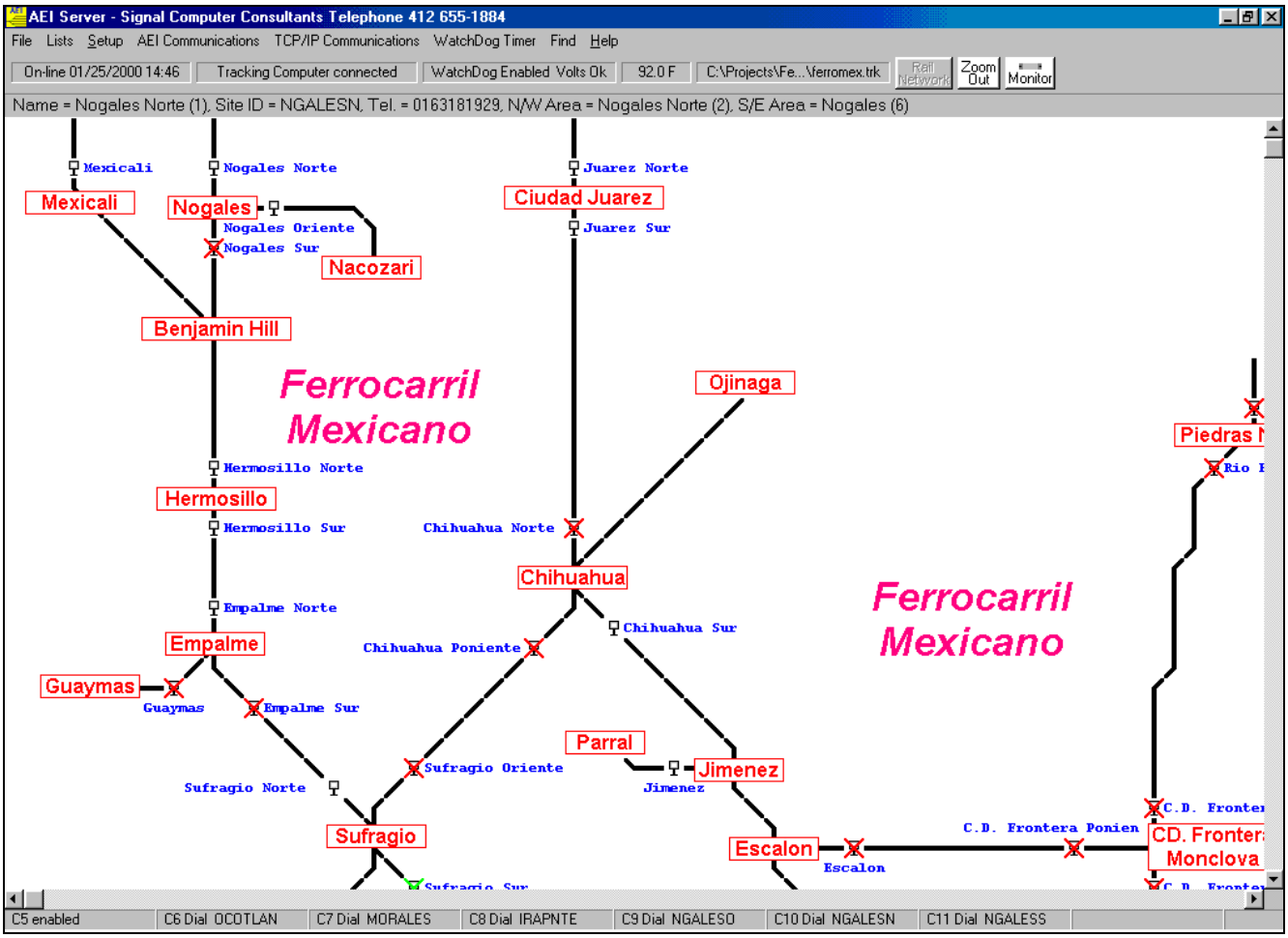


Figure 2 - Rail Network Map

The display in Figure 2 is broken down into four main areas. Staring at the top of the display, these area are: the Server Status Line, which is located immediately below the menu items; the Device Information Line; the network map; and, finally, the Communication Port Status Line, which is at the very bottom of the screen. The following paragraphs describe these areas in more detail.

3.1. Server Status Line

Figure 3 shows the Server Status Line. The first item from the left is the on-line/off-line status of the server. In this example the server is on-line and has been on-line since 25 January 2000 at 14:46.

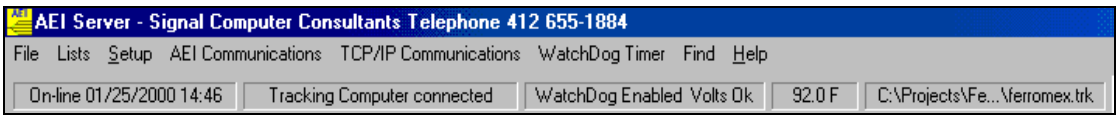

AEI Server - Signal Computer Consultants Telephone 412 655-1884
File Lists Setup AEI Communications TCP/IP Communications WatchDog Timer Find Help
On-line 01/25/2000 14:46
Tracking Computer connected
WatchDog Enabled Volts Ok
92.0 F
C:\Projects\Fe...\ferromex.trk

Figure 3 - Server Status Line

The second item from the left is the status of the connection with the local area network and the tracking computer. In this example the tracking computer is connected, and this server will transfer

AEI tag data to the tracking computer as soon as it is received from the AEI readers over the telephone lines.

The third item is the status of the Watchdog Timer. The Watchdog Timer module, in addition to providing a countdown timer, also monitors the computer's internal voltages and temperature. In this case the Watchdog's countdown timer is enabled and the computer's internal voltages are OK. The internal computer temperature is displayed in the fourth item from the left.

The fifth item from the left shows the Track File the AEI Rail Network Server program is using to create its internal tables. In this case the file name is ferromex.trk.

3.2. Device Information Line

Figure 4 shows the Device Information Line that is located just below the Server Status Line.

AEI Server - Signal Computer Consultants Telephone 412 655-1884
File Lists Setup AEI Communications TCP/IP Communications WatchDog Timer Find Help
On-line 01/25/2000 14:46
Tracking Computer connected
WatchDog Enabled Volts Ok
92.0 F
C:\Projects\Fe...\ferromex.trk
Rail Network
Name = Nogales Norte (1), Site ID = NGALESN, Tel. = 0163181929, N/W Area = Nogales Norte (2), S/E Area = Nogales (6)
Mexicali
Nogales Norte
Juarez Norte
Ciudad Juarez

Figure 4 - Device Information Line

This line shows a portion of the static information about AEI readers, switches and tracking areas. In Figure 4 the mouse pointer was placed on the Nogales Norte reader on the network map, and information about this site appeared in the Device Information Line. For AEI readers this information includes the reader name, site ID, and telephone number. To learn more information about the reader site place the mouse pointer on the reader symbol and click the right mouse button. See Paragraph 9 for more details.

If the mouse pointer were placed on a track segment, information about the tracking area in which the track segment is located would appear.

3.3. Network Map

The most useful tool in finding the status of the AEI reader network is the network map. The network map is located below the Device Information Line and shows the relative geographical positions of all of the AEI readers in the system (see Figure 2).

3.3.1. Reader Symbol Status Codes

The status of each AEI reader in the network is show by the color of the reader symbol or a color-coded X over the reader. The following lists the color-coded status of the AEI reader symbols:

Color of Reader	Color of X over Reader	Reader Status
Black	No X	The status is Ok. The server is not currently trying to communicate with the reader.
Red	No X	The status is Ok. The server is currently trying to connect, transmit or receive data from the reader
Black or Red	Red X	Server has not been able to communicate with the reader for over 12 hours
Black or Red	Blue X	Server has not been able to communicate with the reader for over 4 hours.
Black or Red	Green X	The reader has not sent a train record to the server in over 8 hours. This can either mean that no trains have passed the reader in the last 8 hours or that the AEI reader is having problems sending data.
Black or Red	Black X	Reader has been software disabled. The server will not try to communicate with this device.

3.3.2. AEI Reader Pop-up Menu

Placing the mouse pointer on a reader symbol and clicking the right mouse button will show the pop-up menu in Figure 5.

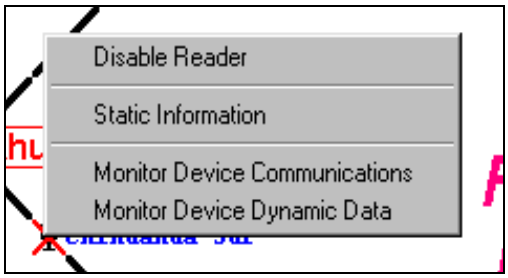


Figure 5 - Reader Pop-up Menu

This menu allows the user to:

- software disable the reader (prevent the server from communicating with the reader)
- display all of the static information on the reader (see Paragraph 9)
- monitor the communications between the server and the reader (see Paragraph 4.5)
- display the detailed status of the reader (see Paragraph 4.4)

3.3.3. Zoom in and Zoom out

The network map has a zoom-in and zoom-out feature. There are two ways to zoom in or zoom out. One way is via the Zoom-In and Zoom-Out button in the toolbar near the top of the screen. Simply click one of these buttons to either zoom in or zoom out.

The second method is to place the mouse pointer anywhere on the network map where a reader or track symbol is not located and click the right mouse button. This will cause the screen to move from the zoom in view to the zoom out view or vice versa. It will also center the new view on the location at which the mouse was located in the old view.

3.4. Communication Status Line

The Communication Status Line is at the bottom of the screen (see Figure 6). This line shows the status of all of the enabled communication ports.

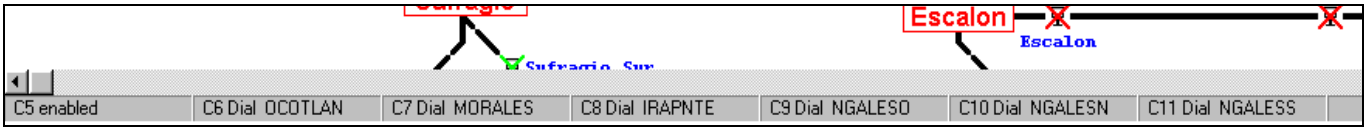


Figure 6 - Communication Status Line

In Figure 6 communication port 5 (C5) is enabled and is available for receiving or transmitting data to the AEI reader sites. Communication ports 6 thru 11 are dialing reader sites. The 7-character Site ID of the AEI reader that the communication port is dialing is also shown in the box.

The following are the communication status codes used in the Communication Status Line:

Code	Description
enabled	Port is available to transmit or receive data from the readers
disabled	Port is not available because a modem could not be found
answering	Port is answering the telephone line, but does not have a modem connection
connected	Port has a modem connection, but has not received a message and, therefore, cannot identify the reader.
RX	Port is receiving data from a reader (reader initiated).
TX	Port is transmitting data to a reader (server initiated).

4. AEI READER COMMUNICATIONS

4.1. Communication Port Status

When the AEI Server program begins it checks the status of all of the communication ports and updates the status in the Communication Status Line. To view the detailed communication port status click the AEI Communications Menu item and then the Communication Port Status item from the secondary menu. The display in Figure 7 will appear.

The user can decide which communication ports will be enabled by checking the appropriate boxes. The server will not try to use any communication port that is not enabled.

Communication port 12 has a modem, but since PC Anywhere was using this port when the communication ports were checked, it was not able to check this device.

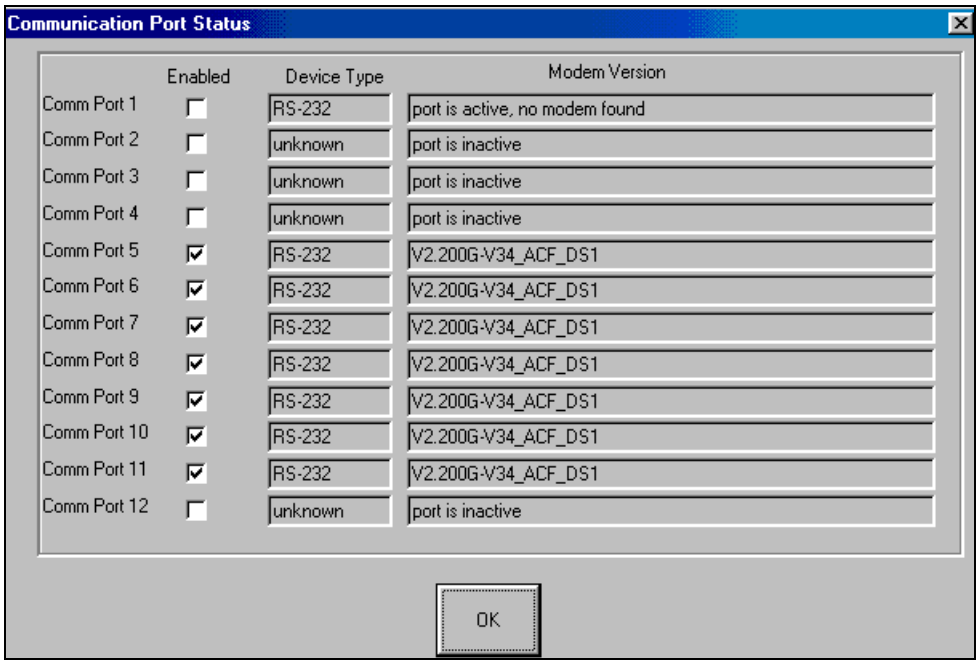


Figure 7 - Communication Port Status

4.2. Turning on AEI Reader Communications

AEI Reader Communications can be turned on or off by the user. To turn the communications on or off click the AEI Communication menu item at the top of the network map screen. This causes a secondary menu to appear. Click the AEI Reader Communications On item to turn communications on or off. This item is checked if communications is on.

4.3. AEI Communications Setup

There are a number of AEI Reader Communications Setup parameters that must be entered. To display and enter these parameters click the AEI Communications menu item at the top of the screen and then the Communications Setup item from the secondary menu. Figure 8 will appear.

When the server dials an AEI reader it uses the telephone number in the reader's information display (see Paragraph 9). It adds the dialing prefix entered in the Communications Setup display to this number if this is required. The dialing prefix does not appear in this example because it is already part of the telephone numbers entered in the readers' information displays.

The incoming telephone number must be entered. This is the number the AEI readers will use to dial the server and send tag information. The AEI server will set up (configure) each AEI reader with this number. Included with this number in the reader's information display is a dialing prefix if the reader is located in a different area code from the server.

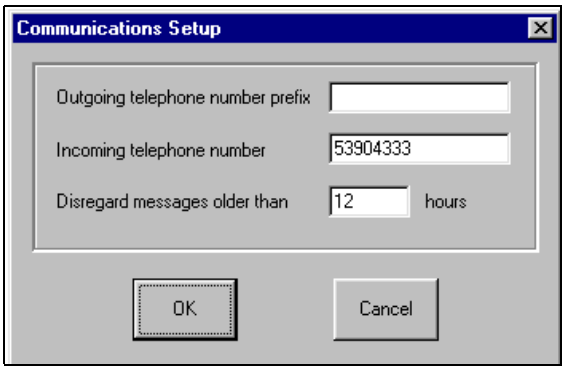


Figure 8 - Communications Setup

The user has the option to disregard messages older than a user specified time period. If an AEI reader has not been able to communicate with the server for a long period of time, but has accumulated train tag messages, it will want to send those messages when communication is re-established. This option prevents very old messages from being sent and entering the system.

4.4. Reader Communication Status

The server records the current AEI reader status. To display this status place the mouse pointer on the reader and click the right mouse pointer. A pop-up menu will appear. Click the Monitor Device Dynamic Data menu item, and Figure 9 will appear.

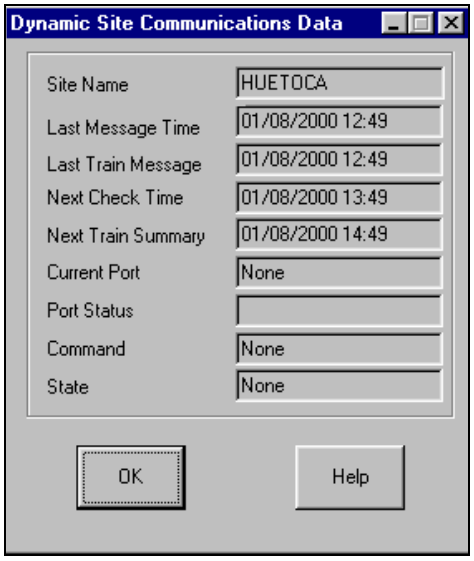


Figure 9 - Device Dynamic Data

This is a dynamic display. It will automatically update as data changes. Multiple Device Dynamic Data displays can be viewed for different readers at the same time. The following describes the fields in this display:

Site Name contains the Site ID

Last Message Time is the last time there was successful communication with the site.

Last Train Message is the last time the AEI reader automatically sent a train message to the server.

Next Check Time is the next time the server will check the AEI reader site by dialing out to it and checking its configuration. This time is calculated by adding the contents (in minutes) of the Check Time field in the reader's information display to the Last Message Time.

Next Train Summary is the next time the server will check the AEI reader to see if it has stored train tag data information that has not been sent to the server. If the reader has train tag data that has not been sent, the server will request that it be sent. The server periodically makes this check based on the time interval specified in the Update Time field in the reader's information display.

Current Port is the port being used if there is currently communications between the reader and server.

Port Status is the status of the port if there is currently communications between the reader and the server.

Command is the current command sequence being sent to the reader.

State is the current state of the communications

4.5. Communications Monitor

The server allows the user to monitor communications between the AEI readers and the server. The easiest way to monitor communications between an AEI reader and the server is to place the mouse pointer on the reader symbol to be monitored and click the right mouse button. This causes a secondary menu to be displayed. Select the Monitor Device Communications, and the display in Figure 10 will appear.

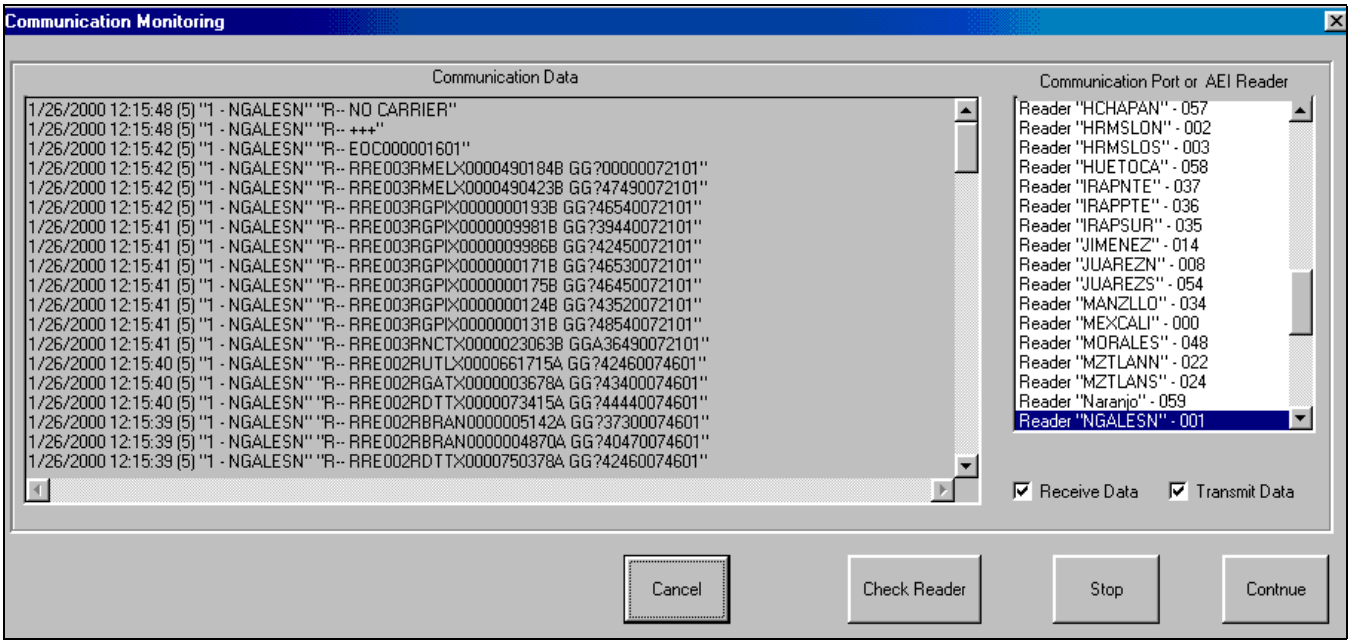


Figure 10 - Monitor Device Communications

This display shows a list of all recent communications with the reader in order from most recent to least recent. Each communication record has:

- the date and time the record was transmitted or received
- the number of the communication port that received or transmitted the message
- the reader number and site ID that the message was sent to or received from
- T or R to indicate whether the message was transmitted by the server to the reader or received by the server
- the transmitted or received message

The screen shown in Figure 10 is a dynamic display which will automatically update every 2 seconds with the latest communication records. This makes it difficult to scroll down the Communication Data list box to see earlier messages. To stop the update, click the Stop button at the bottom of the display. To resume the updating of the screen click the Continue button.

Included with the received messages are messages received and sent to the modem. Messages sent to the modem from the server start with an "AT". The following is a list of some of modem messages and their meaning:

Modem Message	Description
ATDT and (telephone number)	Dial the telephone number
ATH0	Hang up
+++	Escape to command mode (allows the server to send commands rather than data to the modem)
ATA	Answer the telephone
CONNECT and (connection speed)	Modem connection
NO CARRIER	No modem carrier
RING	Line ring from incoming telephone call

The number of messages that can be displayed is limited to the last 5,000 messages received from all readers. There is also a display limit of 40,000 characters of data. Because of these limitations there may be times when no data will appear for a reader that has not had any communications with the server for an extended period of time.

The off-line server will not show any messages.

To limit the display to just the transmitted or received messages, click the appropriate Transmit Data or Receive Data check box located near the bottom right of the display.

The Communication Port or AEI Reader list box on the right side of the display allows the user to select the communication ports or AEI readers to monitor. More than one communication port or reader can be monitored at any given time by making multiple selections in the list box.

At the bottom of the display there is a button to send a check message to a selected reader. For a check message to be sent only one reader and no communication ports must be selected. Otherwise, an error will occur. A check message will be sent immediately if there is a communication port available or when the next communication port becomes available.

The Communication Monitoring display can also be called up from the main screen by clicking on the Monitor button. However, when this button is clicked communications from all readers will be monitored.

4.6. Communication Port Selection

Whenever the server tries to dialup an AEI reader site, it searches for the first available port beginning with the highest communication port number. It will never dial out on the lowest communication port number. The lowest communication port number is reserved for incoming telephone calls.

4.7. Message Formats

Train tag data messages sent from AEI readers to the server are in the T94 format. The data message lines shown in Figure 10 are the tail end of a T94 message sent from a reader. Each message starts with an AEM record (Consist Header Record), a series of RRE records (Rail Equipment Record for each tagged and non-tagged vehicle) and an EOC (End of Consist Record). For more information, obtain a copy of the T94 Common Data Element Specification.

The server periodically checks the AEI readers' configurations and also checks for train tag data that has not been sent to the server. To perform both of these operations the server responds to menus generated by the AEI readers. Individuals using communication programs such as Hyper Terminal and Procomm can also access these menus.

For more information on the AEI readers' menus, see the Southern Technology manuals.

4.8. Communication Log

The servers maintain a log on all communications between the servers and the AEI readers and between the servers and the tracking computer. This log resides on a file called "server comm log.txt". This is a text file that can be accessed by selecting the Lists menu item and the Communication Log item in the secondary menu. This causes the display in Figure 11 to appear.

Like the message lines seen in the Communication Monitor, each message line received shows the data and time it was received, the communication port number, the AEI reader, if known, and a T if the server transmitted the message or an R if received by the server.

Because this file is a text file any word processing program can also access it.

The servers have a file maintenance function that limits the size of this file. See Paragraph 8 for more information.

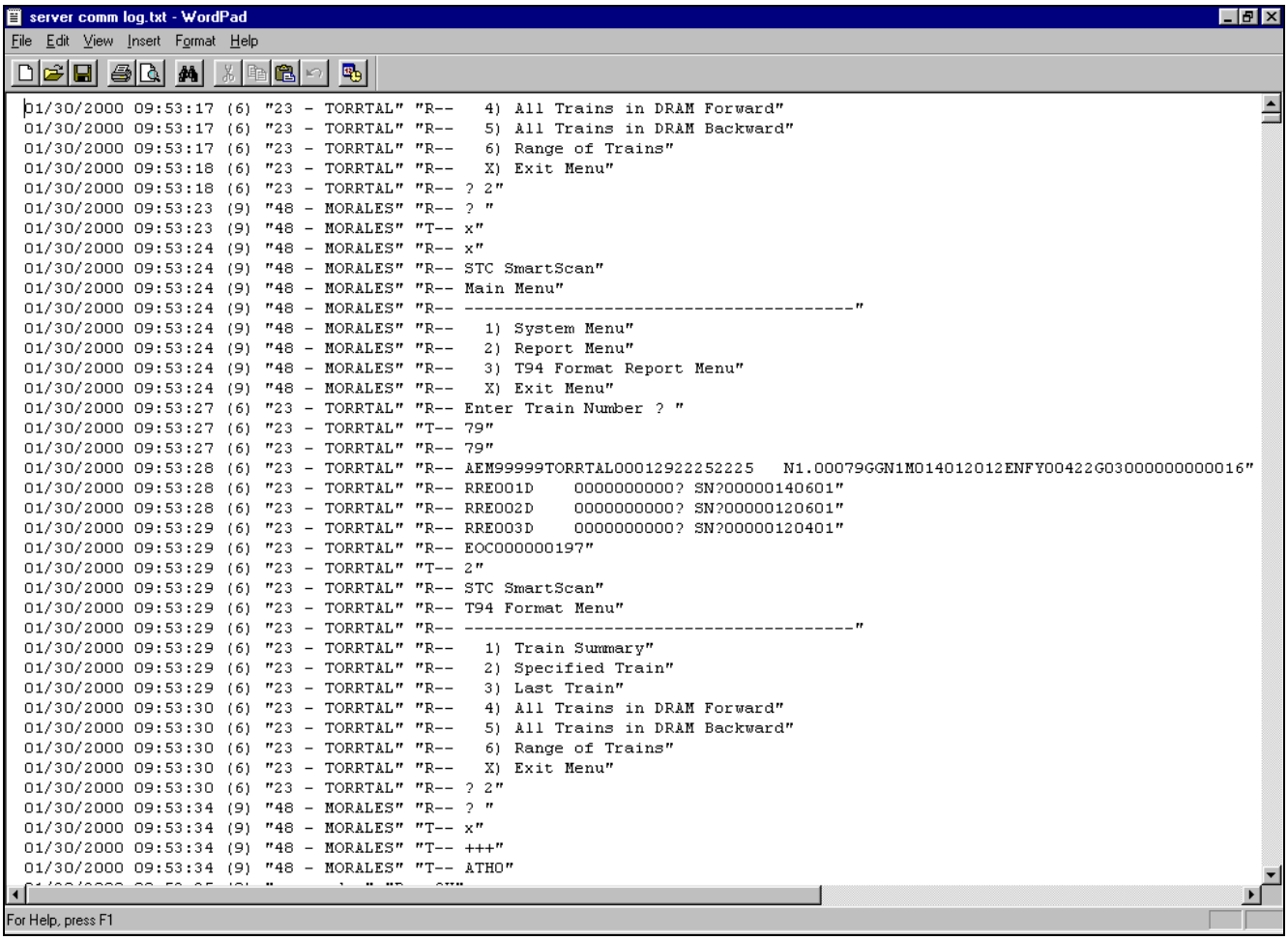


Figure 11 - Communication Log

4.9. Maintenance Log

The server maintains a maintenance log file called “server maint log.txt”. This is a text file that can be accessed by selecting the Lists menu item and the Maintenance Log item in the secondary menu. This causes the display in Figure 12 to appear.

The maintenance file contains system maintenance messages such as when the server started, when it went on-line, when it connected to the tracking computer, etc. It also contains messages about communication problems with the AEI readers.

In the first two lines of Figure 12 two RRE T94 messages have problems starting in the second field. The second field (which is the 7th character of the message line) should contain a R, D, or ?. In both of these message lines, this field contains a number.

In the third line a message was rejected because it was too old. See Paragraph 4.3 for more information about the handling of old messages.

In the fourth line the message was rejected because the server could not identify the AEI reader from which the message was received.

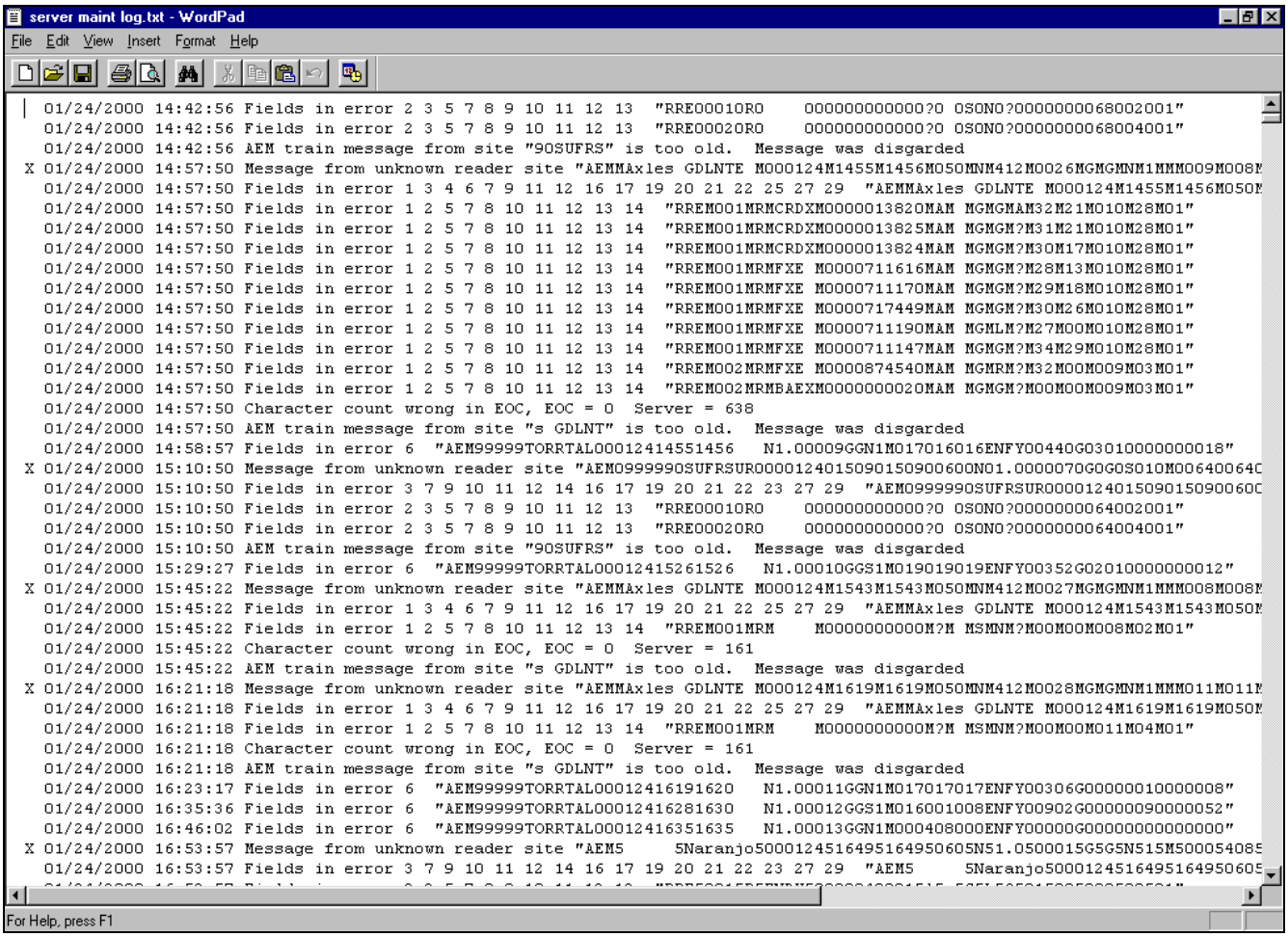


Figure 12 - Maintenance Log

Because this file is a text file any word processing program can also access it.

The servers have a file maintenance function that limits the size of this file. See Paragraph 8 for more information.

5. WATCHDOG TIMER

There are several functions that support the Watchdog Timer. Select the Watchdog Timer menu item to access these functions. A secondary menu will appear which allows the Watchdog Timer to be enabled and disabled. Please note that if the Watchdog timer is disabled and the server is on-line, control will automatically be transferred to the other server.

The Watchdog Timer has a setup function that can be accessed by selecting Watchdog Setup/Status/Control Override item. When this function is selected Figure 13 will appear.

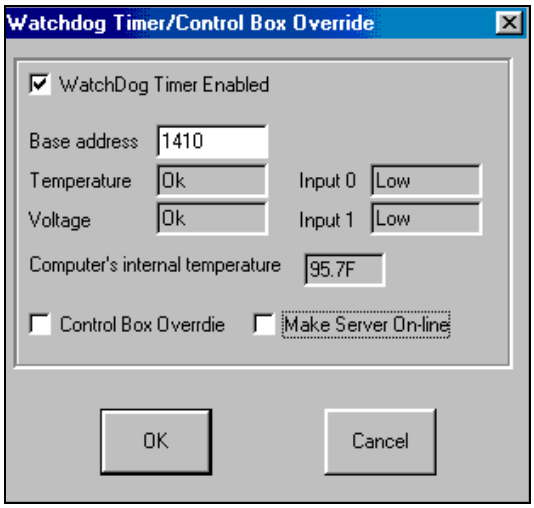


Figure 13 - Watchdog Timer Setup

Figure 13 shows the status of the Watchdog Timer. The status includes whether the countdown timer is enabled (Watchdog Timer Enabled), the status of the temperature, internal voltages, and input lines and also shows the computer's internal temperature.

There is also a field called Base address which is the hardware address of the Watchdog Timer in the computer. This should not be changed.

The Watchdog Timer has two input lines, one of which is connected to the Computer Control Box. The input from these lines informs the server if it is the on-line or the off-line server.

Another function of this display is to override the Computer Control Box. If Control Box Override is checked, the AEI Server program will ignore the on-line/off-line hardware input from the Computer Control Box and instead use the value of the Make Server On-line check box to determine the on-line/off-line status of the server. If this box is checked and the Control Box Override is checked, the server will be on-line.

The purpose of this override is to allow the servers to function if there are problems with the Computer Control Box or the Watchdog Timer's input lines. Please note that if the override function is used, the telephone lines will have to be manually switched to the on-line server. There is a switch on the right hand corner of the gang switch that allows the telephone lines to be manually switched from one server to another.

6. TCP/IP COMMUNICATIONS

The AEI Servers, when they receive train tag data from AEI reader sites, immediately send this information to the AEI tracking computer over the local area network using the TCP/IP protocol.

TCP/IP communications with the AEI tracking computer can be enabled or disabled by selecting the TCP/IP Communications menu item and then selecting the TCP/IP Communications On item. If this item is checked, the TCP/IP communications is already on and will be turned off if selected again.

The TCP/IP communications also has a setup function that can be accessed by selecting the TCP/IP Communications menu and then the TCP Setup item in the secondary menu. The display in Figure 14 will then appear.

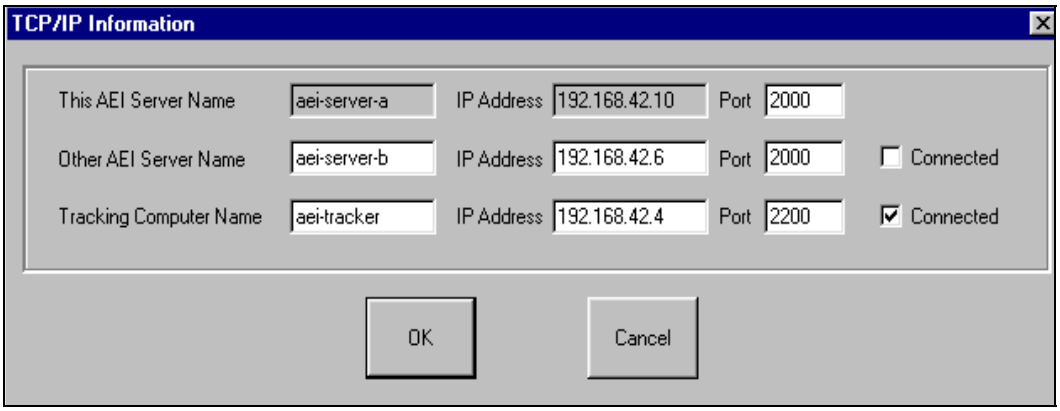


Figure 14 - TCP/IP Setup

TCP/IP communications requires that the servers and the tracking computer have their own IP addresses. The AEI Rail Network Server program gets the name and IP address of the computer on which it is running directly from the operating system. The IP addresses for the other server and the tracking computer can be obtained from those computers by running the AEI Rail Network Server or AEI Rail Network Tracker programs and using the TCP/IP Setup function.

The user can assign names and IP addresses by going to Start/Settings/Control Panel/Network. The Network dialog will then appear. To enter the name the user selects the Identification Tab and enters the name.

To enter the IP address the user then selects the Configuration Tab, finds and selects the TCP/IP LAN device and clicks the Properties button. On the next display the IP Address Tab should be selected. The user then clicks the Specify an IP Address button and enters the IP address and subnet mask. The subnet mask should be 255.255.255.0. The IP address can be any number; however, each computer must have a unique address, and the first three groups of digits (groups are separated by a period) in the IP address must be the same for all computers.

7. T94 TRAIN MESSAGE QUEUE

The server saves the last 1,000 T94 messages it receives from the AEI readers in a circular queue. When the queue becomes full the oldest message is replaced by the newest. When new messages are received the server immediately updates the T94 Train Message Queue in the off-line server.

Each message in the queue has a flag that indicates if the message was successfully sent to the AEI tracking computer.

To access the T94 Train Message Queue, select the List menu and then the T94 Train Message Queue item from the secondary menu. The display in Figure 15 will appear.

Figure 15 allows the user to search the T94 Train Message Queue by time and date and/or by AEI reader site identification. After selecting the parameters of the search, click OK, and Figure 16 will appear.

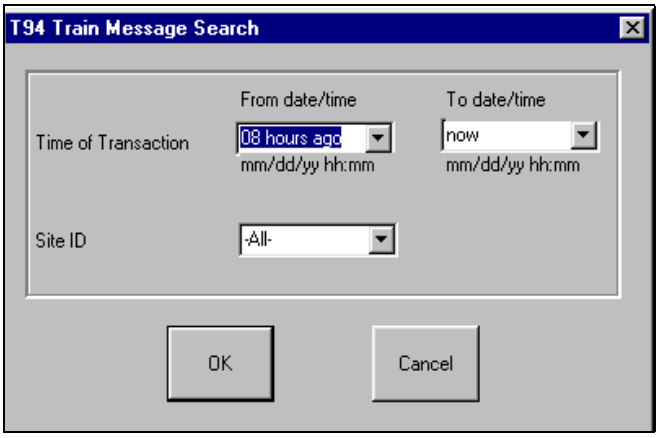
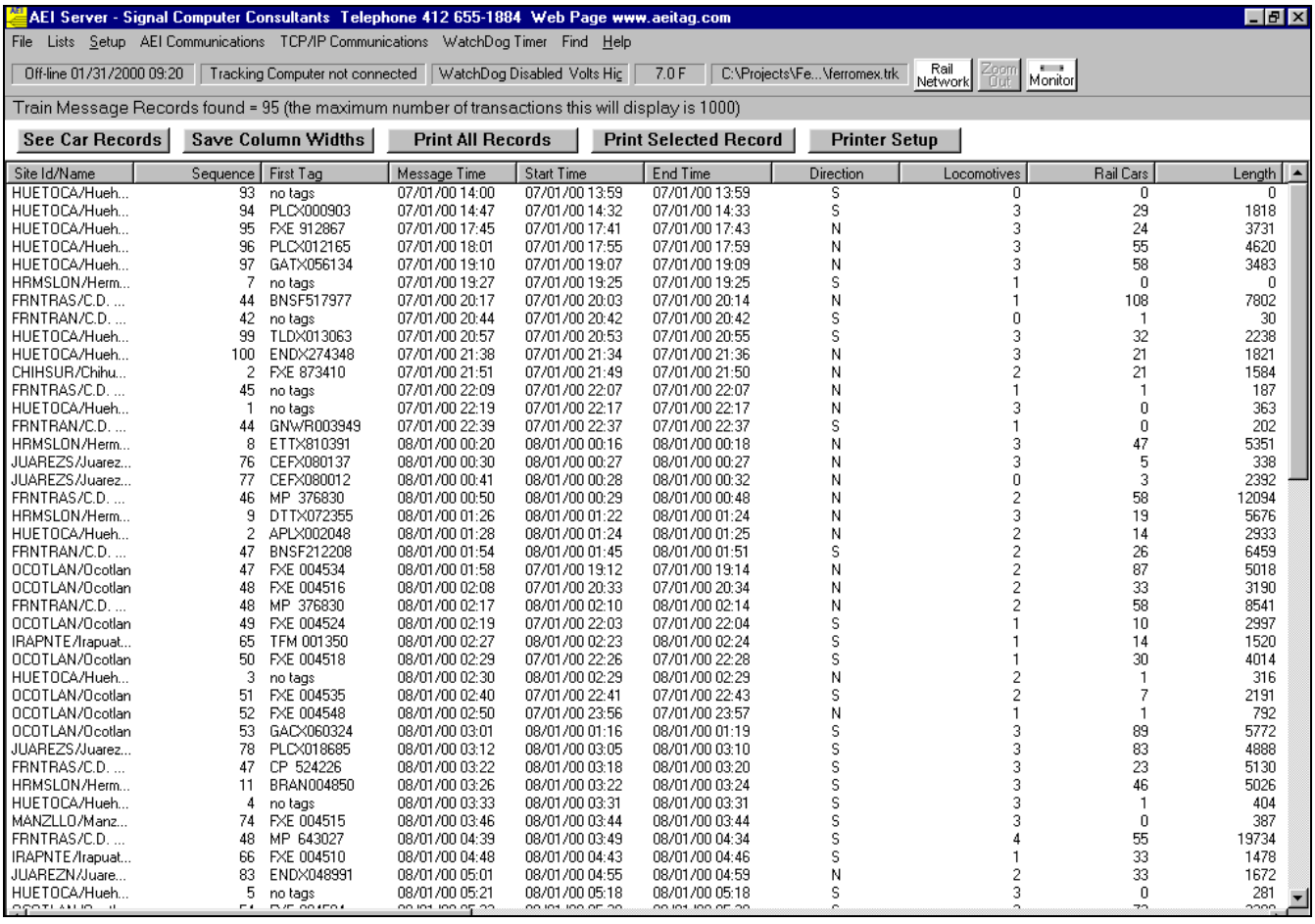


Figure 15 - T94 Train Message Search


AEI Server - Signal Computer Consultants Telephone 412 655-1884 Web Page www.aeitag.com
File Lists Setup AEI Communications TCP/IP Communications WatchDog Timer Find Help
Off-line 01/31/2000 09:20
Tracking Computer not connected
WatchDog Disabled Volts Hig
7.0 F
C:\Projects\Fe...\ferromex.trk
Rail Network
Zoom Out
Monitor
Train Message Records found = 95 (the maximum number of transactions this will display is 1000)
See Car Records
Save Column Widths
Print All Records
Print Selected Record
Printer Setup

Site Id/Name	Sequence	First Tag	Message Time	Start Time	End Time	Direction	Locomotives	Rail Cars	Length
HUETOCA/Hueh...	93	no tags	07/01/00 14:00	07/01/00 13:59	07/01/00 13:59	S	0	0	0
HUETOCA/Hueh...	94	PLCX000903	07/01/00 14:47	07/01/00 14:32	07/01/00 14:33	S	3	29	1818
HUETOCA/Hueh...	95	FXE 912867	07/01/00 17:45	07/01/00 17:41	07/01/00 17:43	N	3	24	3731
HUETOCA/Hueh...	96	PLCX012165	07/01/00 18:01	07/01/00 17:55	07/01/00 17:59	N	3	55	4620
HUETOCA/Hueh...	97	GATX056134	07/01/00 19:10	07/01/00 19:07	07/01/00 19:09	N	3	58	3483
HRMSLON/Herm...	7	no tags	07/01/00 19:27	07/01/00 19:25	07/01/00 19:25	S	1	0	0
FRNTRAS/C.D. ...	44	BNSF517977	07/01/00 20:17	07/01/00 20:03	07/01/00 20:14	N	1	108	7802
FRNTRAN/C.D. ...	42	no tags	07/01/00 20:44	07/01/00 20:42	07/01/00 20:42	S	0	1	30
HUETOCA/Hueh...	99	TLDX013063	07/01/00 20:57	07/01/00 20:53	07/01/00 20:55	S	3	32	2238
HUETOCA/Hueh...	100	ENDX274348	07/01/00 21:38	07/01/00 21:34	07/01/00 21:36	N	3	21	1821
CHIHSUR/Chihu...	2	FXE 873410	07/01/00 21:51	07/01/00 21:49	07/01/00 21:50	N	2	21	1584
FRNTRAS/C.D. ...	45	no tags	07/01/00 22:09	07/01/00 22:07	07/01/00 22:07	N	1	1	187
HUETOCA/Hueh...	1	no tags	07/01/00 22:19	07/01/00 22:17	07/01/00 22:17	N	3	0	363
FRNTRAN/C.D. ...	44	GNWR003949	07/01/00 22:39	07/01/00 22:37	07/01/00 22:37	S	1	0	202
HRMSLON/Herm...	8	ETTX810391	08/01/00 00:20	08/01/00 00:16	08/01/00 00:18	N	3	47	5351
JUAREZS/Juarez...	76	CEFX080137	08/01/00 00:30	08/01/00 00:27	08/01/00 00:27	N	3	5	338
JUAREZS/Juarez...	77	CEFX080012	08/01/00 00:41	08/01/00 00:28	08/01/00 00:32	N	0	3	2392
FRNTRAS/C.D. ...	46	MP 376830	08/01/00 00:50	08/01/00 00:29	08/01/00 00:48	N	2	58	12094
HRMSLON/Herm...	9	DTTX072355	08/01/00 01:26	08/01/00 01:22	08/01/00 01:24	N	3	19	5676
HUETOCA/Hueh...	2	APLX002048	08/01/00 01:28	08/01/00 01:24	08/01/00 01:25	N	2	14	2933
FRNTRAN/C.D. ...	47	BNSF212208	08/01/00 01:54	08/01/00 01:45	08/01/00 01:51	S	2	26	6459
OCOTLAN/Ocotlan	47	FXE 004534	08/01/00 01:58	07/01/00 19:12	07/01/00 19:14	N	2	87	5018
OCOTLAN/Ocotlan	48	FXE 004516	08/01/00 02:08	07/01/00 20:33	07/01/00 20:34	N	2	33	3190
FRNTRAN/C.D. ...	48	MP 376830	08/01/00 02:17	08/01/00 02:10	08/01/00 02:14	N	2	58	8541
OCOTLAN/Ocotlan	49	FXE 004524	08/01/00 02:19	07/01/00 22:03	07/01/00 22:04	S	1	10	2997
IRAPNTE/Irapuat...	65	TFM 001350	08/01/00 02:27	08/01/00 02:23	08/01/00 02:24	S	1	14	1520
OCOTLAN/Ocotlan	50	FXE 004518	08/01/00 02:29	07/01/00 22:26	07/01/00 22:28	S	1	30	4014
HUETOCA/Hueh...	3	no tags	08/01/00 02:30	08/01/00 02:29	08/01/00 02:29	N	2	1	316
OCOTLAN/Ocotlan	51	FXE 004535	08/01/00 02:40	07/01/00 22:41	07/01/00 22:43	S	2	7	2191
OCOTLAN/Ocotlan	52	FXE 004548	08/01/00 02:50	07/01/00 23:56	07/01/00 23:57	N	1	1	792
OCOTLAN/Ocotlan	53	GACX060324	08/01/00 03:01	08/01/00 01:16	08/01/00 01:19	S	3	89	5772
JUAREZS/Juarez...	78	PLCX018685	08/01/00 03:12	08/01/00 03:05	08/01/00 03:10	S	3	83	4888
FRNTRAS/C.D. ...	47	CP 524226	08/01/00 03:22	08/01/00 03:18	08/01/00 03:20	S	3	23	5130
HRMSLON/Herm...	11	BRAN004850	08/01/00 03:26	08/01/00 03:22	08/01/00 03:24	S	3	46	5026
HUETOCA/Hueh...	4	no tags	08/01/00 03:33	08/01/00 03:31	08/01/00 03:31	S	3	1	404
MANZLLO/Manz...	74	FXE 004515	08/01/00 03:46	08/01/00 03:44	08/01/00 03:44	S	3	0	387
FRNTRAS/C.D. ...	48	MP 643027	08/01/00 04:39	08/01/00 03:49	08/01/00 04:34	S	4	55	19734
IRAPNTE/Irapuat...	66	FXE 004510	08/01/00 04:48	08/01/00 04:43	08/01/00 04:46	S	1	33	1478
JUAREZN/Juare...	83	ENDX048991	08/01/00 05:01	08/01/00 04:55	08/01/00 04:59	N	2	33	1672
HUETOCA/Hueh...	5	no tags	08/01/00 05:21	08/01/00 05:18	08/01/00 05:18	S	3	0	281

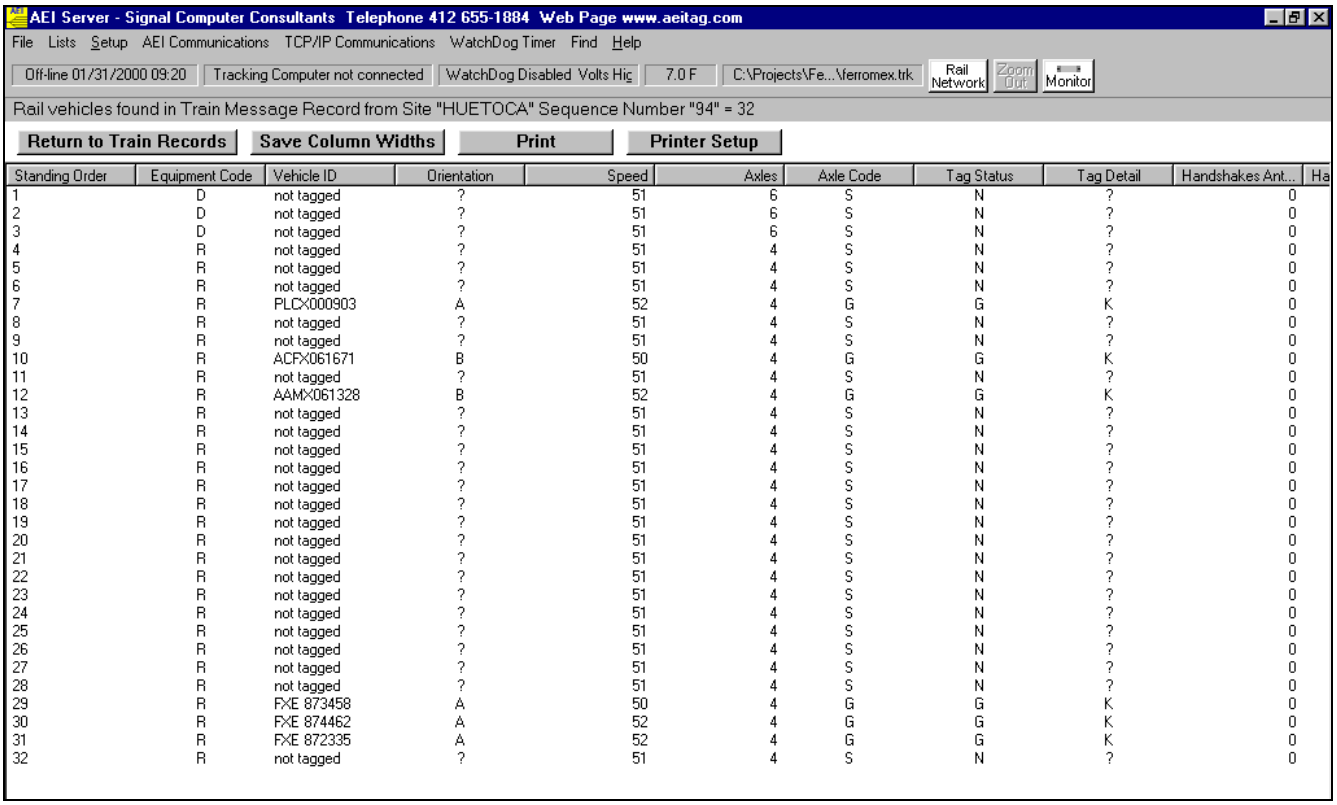
Figure 16 - T94 Train Message Queue

Figure 16 shows each train record. Included with the train record is:

- the AEI reader site identification of the reader that sent the train data
- the sequence number assigned to the train by the AEI reader (each AEI reader can hold 100 trains and assigns a sequence number from 0 to 99 to each train)

- the date and time the message was received by the server
- the date and time the AEI reader first detected the train
- the date and time the AEI reader stopped processing the train
- the direction of travel
- the number of locomotives and cars
- the length of the train
- the minimum, maximum and average speed of the train
- the number of axles
- the number of tagged locomotives and cars
- various other parameters that are described in the description of the T94 Specification for AEM records

To show a complete list of the vehicle records in a train message highlight the appropriate line of the display shown in Figure 16 and then click the See Car Records button near the top of the screen. This will cause a list as shown in Figure 17 to appear.


AEI Server - Signal Computer Consultants Telephone 412 655-1884 Web Page www.aeitag.com
File Lists Setup AEI Communications TCP/IP Communications WatchDog Timer Find Help
Off-line 01/31/2000 09:20
Tracking Computer not connected
WatchDog Disabled Volts Hig
7.0 F
C:\Projects\Fe...\ferromex.trk
Rail Network
Zoom Out
Monitor
Rail vehicles found in Train Message Record from Site "HUETOCA" Sequence Number "94" = 32
Return to Train Records
Save Column Widths
Print
Printer Setup

Standing Order	Equipment Code	Vehicle ID	Orientation	Speed	Axles	Axle Code	Tag Status	Tag Detail	Handshakes Ant...	Ha
1	D	not tagged	?	51	6	S	N	?	0	
2	D	not tagged	?	51	6	S	N	?	0	
3	D	not tagged	?	51	6	S	N	?	0	
4	R	not tagged	?	51	4	S	N	?	0	
5	R	not tagged	?	51	4	S	N	?	0	
6	R	not tagged	?	51	4	S	N	?	0	
7	R	PLCX000903	A	52	4	G	G	K	0	
8	R	not tagged	?	51	4	S	N	?	0	
9	R	not tagged	?	51	4	S	N	?	0	
10	R	ACFX061671	B	50	4	G	G	K	0	
11	R	not tagged	?	51	4	S	N	?	0	
12	R	AAMX061328	B	52	4	G	G	K	0	
13	R	not tagged	?	51	4	S	N	?	0	
14	R	not tagged	?	51	4	S	N	?	0	
15	R	not tagged	?	51	4	S	N	?	0	
16	R	not tagged	?	51	4	S	N	?	0	
17	R	not tagged	?	51	4	S	N	?	0	
18	R	not tagged	?	51	4	S	N	?	0	
19	R	not tagged	?	51	4	S	N	?	0	
20	R	not tagged	?	51	4	S	N	?	0	
21	R	not tagged	?	51	4	S	N	?	0	
22	R	not tagged	?	51	4	S	N	?	0	
23	R	not tagged	?	51	4	S	N	?	0	
24	R	not tagged	?	51	4	S	N	?	0	
25	R	not tagged	?	51	4	S	N	?	0	
26	R	not tagged	?	51	4	S	N	?	0	
27	R	not tagged	?	51	4	S	N	?	0	
28	R	not tagged	?	51	4	S	N	?	0	
29	R	FXE 873458	A	50	4	G	G	K	0	
30	R	FXE 874462	A	52	4	G	G	K	0	
31	R	FXE 872335	A	52	4	G	G	K	0	
32	R	not tagged	?	51	4	S	N	?	0	

Figure 17 - Vehicle Records

Figure 17 shows:

- the position of the vehicle in the train in the direction of travel
- the type of vehicle (D for locomotive, R for rail cars)
- the vehicle identification
- orientation of the vehicle in the direction of travel (locomotives have an F for front-end and an R for rear-end; rail cars have an A or B, the B end of a rail car being the end where the hand brake s usually located)
- speed of the vehicle as it passed the AEI reader
- the number of axles on the vehicle
- various other parameters regarding the status of the AEI tags. See the T94 Specification for RRE records for more information.

The user can resize any of the columns in the displays shown in Figure 16 and Figure 17 by placing the mouse pointer on the line separating two columns in the column header, clicking the left mouse button and dragging the mouse to the left or right. Once resized the column size information can be saved by clicking the Save the Column Widths button located above the column headers.

8. FILE MAINTENANCE

The AEI Server program can automatically limit the size of the Communication Log and Maintenance Log files and can automatically make backup copies of the T94 Train Message file. To set up these function select the Setup menu item and then the File Maintenance item from the secondary menu. The display in Figure 18 will appear.

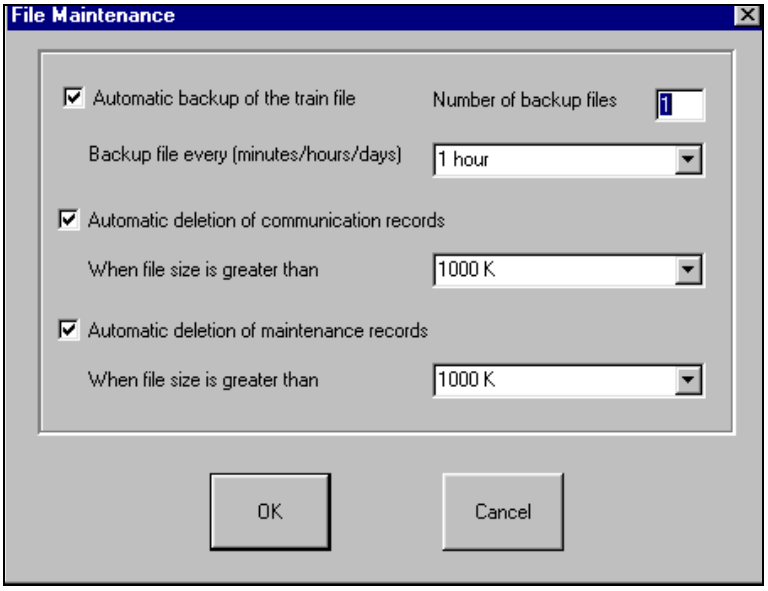


Figure 18 - File Maintenance

Figure 18 allows the user to decide how many backup copies of the T94 Train Message file will exist at any given time. Up to 99 copies can be automatically maintained by the system. The most recent backup copy will be named "train records.b01". The next most recent will have a .b02 extension.

The maintenance and communication logs are constantly growing. The AEI Server has a function to automatically limit the size of these files. The user can specify in the display shown in Figure 18 the maximum size of these files. The oldest records in these files will then be eliminated to prevent the files from exceeding their maximum size.

9. AEI READER INFORMATION

The system has a considerable amount of information about each AEI reader. To display this information place the mouse pointer on the AEI reader in the network map and click the right mouse button. This causes a pop-up menu to be displayed. By selecting the Static Information item from the pop-up menu the dialog in Figure 19 is displayed. None of data contained in Figure 19 can be changed in the AEI Rail Network Server program. The AEI readers' static data can only be changed by using the AEI Rail Network Builder program.

Figure 19 shows the data fields associated with each reader. The following describes each of the fields:

AEI Reader Number — the number assigned to the reader

Name — a 20-character name assigned to the AEI reader

Site ID — a 7-character site identification name assigned to the AEI reader

Telephone — the telephone number the AEI servers will use to call this AEI reader site. All access control and long distances pre-fixes are included with this number.

Password — a 20-character password that allows the AEI servers to access the AEI reader site. Currently Southern Technology's AEI reader sites do not support password protection.

Owner — a 20-character name of the owner of the AEI reader site.

Dial-out #1 prefix — the area code, country code and other necessary pre-fixes that may be necessary to dial out to the server in the event the server is not in the same area code as the reader. The AEI Rail Network Server program accesses this prefix from the track file that is created by the AEI Rail Network Builder program and includes it with the server's telephone number that is automatically sent to the AEI readers by the AEI Servers. See Paragraph 4.3 for information about entering the server's incoming number into the system.

Dial-out #2 — the telephone number, including any necessary prefixes, of a second computer system that the AEI reader can dial when it has new AEI tag data to send. If this field is blank, no number will be dialed.

Dial-out #3 — the telephone number, including any necessary pre-fixes, of a third computer system that the AEI reader can dial when it has new AEI tag data to send. If this field is blank, no number will be dialed.

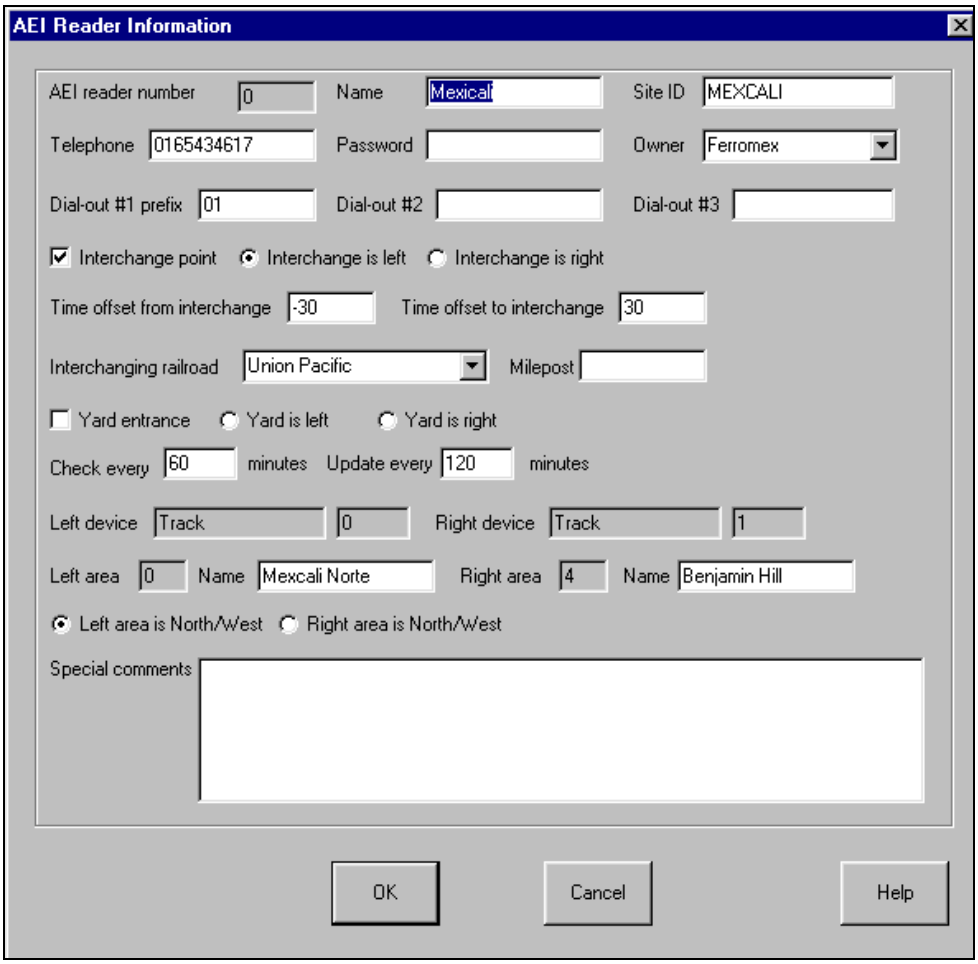


Figure 19 - AEI Reader Static Information

Interchange point if this field is checked, the AEI reader is associated with an interchange point with another railroad.

Interchange is left if selected, the location of the interchange point is on the track segment linked to the AEI reader on the left

Interchange is right if selected, the location of the interchange point is on the track segment linked to the AEI reader on the right.

Time offset from interchange a constant that represents the time, in minutes, it takes to travel the distance, if any, between the reader and an associated point where cars are interchanged with another railroad. This constant is always added to the tag read time to calculate the time of interchange for vehicles arriving from another railroad. It will normally be a negative number so that the tag read time is actually decremented to calculate the interchange time. Only in instances where the vehicles arriving from another railroad pass the associated reader prior to the interchange will the constant be a positive number.

Time offset to interchange this field serves the same function as the previous field for vehicles departing to another railroad and will normally be a positive number. Only in instances where the vehicles departing to another railroad pass the associated reader subsequent to the interchange will the constant be a negative number.

Interchanging railroad 20-character name of the interchanging railroad.

Milepost 10-character milepost designation for the AEI reader.

Yard entrance the AEI Rail Network System is designed to work with the AEI Rail and Road Terminal Manager. This check box indicates if the AEI reader is associated with a yard entrance.

Yard is left if selected, the location of the yard entrance is on the track linked to the AEI reader on the left.

Yard is right if selected, the location of the yard entrance is on the track linked to the AEI reader on the right.

Check time AEI Servers periodically dial out to the AEI reader sites to check if they are operating correctly.

Update Time AEI Servers periodically dial out to the AEI reader sites to check if any AEI reader sites have stored trains that have not been sent to the AEI Servers. If an AEI reader has stored tag information for trains that have not been sent to the AEI Server, the AEI Server will request that the train data be sent.

Left Device the device type and device number of the device linked to the left of the AEI reader.

Right Device the device type and device number of the device linked to the right of the AEI reader.

Area Left the number of the tracking area associated with the track segment linked to the left of the AEI reader.

Area Name the name for the tracking area associated with the track segment linked to the left of the AEI reader.

Area Right the number of the tracking area associated with the track linked to the right of the AEI reader.

Area Name the name for the tracking area associated with the track segment linked to the right of the AEI reader.

Left Area is North/West AEI readers report AEI tag directions as either North/South or West/East. This button is used to indicate which of the two linked tracking areas is to the North or West of the AEI reader. If selected, the left tracking area is to the North or West of the AEI reader.

Right Area is North/West If selected, the right tracking area is to the North or West of the AEI reader.

Special Comments text comments about the site, which are entered by the user of the AEI Network Builder program.

10. MISCELLANEOUS FUNCTIONS

10.1. Finding Devices and Areas

To find AEI readers, tracking areas or yards, click the Find menu item at the top of the screen. This causes a secondary menu to appear from which you can select the type of device or the tracking area you want to find. Figure 20 shows the results of selecting the Find Tracking Area menu item.

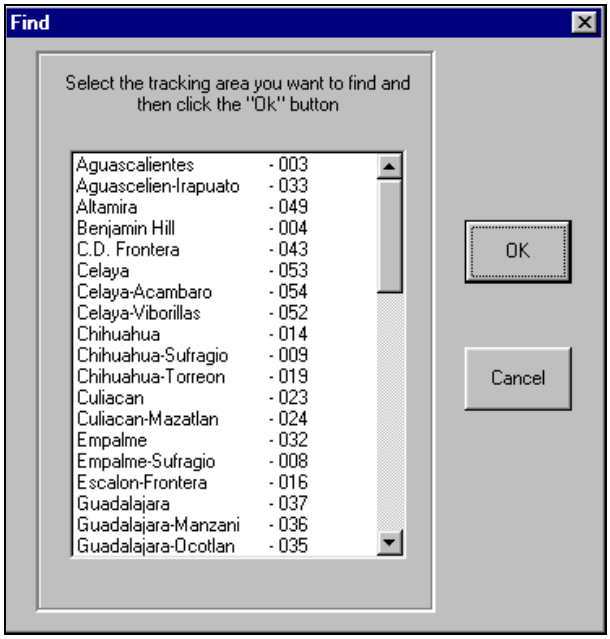


Figure 20 - Find Tracking Area

To locate a particular tracking area, click on the name in Figure 20, and the mouse pointer will jump on the screen to the location of this tracking area.

10.2. Printing Layout Display

To print the layout display, select the File menu and then Print from the secondary menu.

11. TECHNICAL SUPPORT AND UPDATES

For technical support or more information on the maintenance agreement contact Signal Computer Consultants at:

Signal Computer Consultants
P.O. Box 18445
Pittsburgh, PA 15236

Tel. 888 872-4612 (toll free US and Canada only) or 412 655-1884
Fax. 412 655-1893
E-mail signal@signalcc.com
Web Page www.aeitag.com

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